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International Technical Co-operation

Mr. H. A. Knight, in an editorial in the April issue of "Metals and Alloys"—an American magazine of very considerable influence—says very definitely that when the war is over steel and metal producers from the Axis powers and others are to be debarred from visiting American plants. He recounts how Japanese industrialists have abused hospitality by taking photographs by means of secreted cameras. Turning out, on our return to our London office, some old papers, we unearthed a collection of photographs taken in connection with the International Foundry Congress held in June, 1939. One depicts a bullet-headed Hun in the act of snapping the interior of a provincial works; others show the Germans busily filling up their note-books. Yet we do not fear that information of a vital character was placed at the disposal of either the Luftwaffe or the Wehrmacht, for the acquisition of knowledge during a works visit is too fragmentary to be of real use On the other hand, the exchange of students as between nations does afford opportunities for the harvesting of useful technical and commercial information. We have seen many years ago Japanese students acting as crane drivers in one of our largest steelworks.

Generally speaking, a quick tour through a foreign works gives the visitor a useful impression of the working conditions; the extent to which machinery has been applied; the organisation of routing and handling—if not too complicated, an appreciation of the heating, lighting and ventilation systems—but not much else. Here and there a useful trick of the trade may be picked up, which can—and, in fact, has been known to be—of the greatest value. Notes taken during a visit as to the spacing of machines, the types of conveyors and the like may record the very facts which the foundry manager would change if he were redesigning the plant.

There is little wisdom in announcing a closed-shop policy for works visits from aliens, for no country has a monopoly of manufacturing brains, but any system devised should be reciprocal. Just as in wartime, allied co-operation produced the weapons to gain an overwhelming victory in Europe, so, too, similar action in the future—suitably adjusted—should go far towards raising the standard of living throughout the world, and so help the manufacturing communities of all countries. Yet we feel that we must subscribe to the suggestion that representatives from the Axis powers should be debarred from visiting the foundries of the United Nations, until they have been thoroughly re-educated. Current opinion is that in the past they had only the expansion of their war industries in mind. Moreover, they applied a bar to the inclusion of certain of named British representatives for certain works visits on the occasion of international conferences—a system very easily overcome by the mere "swapping" of invitation tickets. If the International Technical Committee of Foundrymen is re-established, we would suggest the exclusion of the Axis powers for at least a decade. If something of technical interest and importance be lost, there will be truer harmony amongst the participants which will make for closer technical co-operation.

THE RAILWAY ENGINEERING SUPPLY INDUSTRIES, which comprise an important section of the potential export trade of Great Britain, are making a bid for the important Latin-American market through their Joint Committee created at the suggestion of the Government in 1942 and representing more than 120 companies with a capital of over £26 million and employing 60,000 people. The approach is made by the issue of a profusely illustrated technical publication—in Spanish for the Spanish-speaking Republics and in Portuguese for Brazil—called "Technical Progress in Railway Equipment."

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INSTITUTE ELECTS NEW MEMBERS

FIRST LIST

As Members

E. A. E. Brindley, metallurgist, C. & B. Smith, Limited, Wolverhampton; R. A. Jones, foundry manager; W. Riseley, foundry manager, J. T. Etchells, Macclesfield; F. Wood, partner, W. A. Musgrove, Manchester; W. G. Maw, works manager, R. A. Lister & Company, Limited, Dursley; J. Timbrell (transferred), foundry manager, Yorkshire Repetition Castings, Limited, Bradford.

As Associate Members

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As Subscribing Firm Member

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As Members

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As Associate Members

A. C. Carswell, metallurgist, Magnesium Castings Products, Limited, Slough; J. D. Doyle, B.Met.E., superintendent, Commonwealth Aircraft Corporation, Melbourne, Australia; M. Furlong, assistant foundry foreman, L.N.E.R., Glasgow; G. Hanson, under foreman, Lightalloys, Limited, Willesden; M. Kent, brassmoulder, Samuel Birkett & Sons (Cleckheaton), Limited; A. McCulloch, foundry draughtsman, Clyde Alloy Steel Company, Motherwell; C. F. Marsh, senior foreman, L.N.E.R., Glasgow; J. Mills, technical assistant, Anderson-Grice Company, Limited, Carnoustie; D. W. Parkin, technical engineer, Guest & Chrimes, Limited, Rotherham; T. Telichowski, technical engineer, Institute of Technical Research; L. Wood, production liaison officer, Eclipse Foundry, Birmingham; J. M. Goymour (transferred), metallurgist, Renshaw Foundry, Staines, Middlesex.

As Associate (Student)

A. R. Palmer, metallurgical apprentice, Ransomes & Rapier, Limited, Ipswich.

NATIONAL CERTIFICATES IN APPLIED PHYSICS

The announcement by the Ministry of Education of a scheme for the award of ordinary and higher national certificates in applied physics brings to fruition one of the recommendations made in the Institute of Physics Report on Education and Training issued in 1943. Prospective students may obtain further particulars of the courses from their local technical colleges or local director of education. The courses are designed not only to lead to a well recognised qualification in the national certificate, but at the same time to be of particular benefit to the student by the additional knowledge he will gain. Moreover, the course for the ordinary national certificate is intended to lead on to that for the higher national certificate, the award of which will be recognised as a definite stage towards the first rung of the professional ladder, the Associateship of the Institute of Physics (A.Inst.P.).

Employers will find these courses provide just that training for which many have been asking. With a rapid growth of physics in industry and in the different Government services, it has been found that the existing courses in branches of engineering, in chemistry and so on do not singly provide the combination of knowledge required by juniors in some branches of work which depend on the advances of science, such as, for example, the physical testing of materials and the maintenance and use of instruments for the measurement and control of different processes.

Outline of the Type of Courses

Space does not allow more than the barest outline of the type of courses that would be approved. The three-year part-time course for the ordinary national certificate must include mathematics, physics and chemistry, and in the first year a special course (not the orthodox engineering one) in workshop practice and drawing. The physics in the course is to be treated realistically and the principles are, whenever possible, to be illustrated by practical examples drawn from the industries in which the students are working. The course in applied physics in the final years is to be related to the local industries. Although English is not included formally as a subject in the course, it is a part of the scheme that at all stages and in all classes attention is to be paid to its correct use. It is hoped in this way to help to train students to present written statements which are clear and concise, when in the course of their employment they are required to report on their work.

The course for the higher national certificate must be a two-year part-time one and must aim at reaching a standard in the several branches of physics corresponding to that required for a degree in the subject at pass standard. It will include mathematics and a special subject related to the student's daily work in local industry.

THE FUTURE OF THE LIGHT ALLOY FOUNDRY INDUSTRY*

Its important part in the critical years which lie ahead

By W. C. DEVEREUX, F.R.Ae.S., M.I.A.E. (Member)
(Chairman and managing director, High Duty Alloys, Limited, managing director, Magnesium Castings & Products, Limited

When I was asked to present this Edward Williams lecture the winning of the war was still the main concern of us all, but I resolved then that the best way in which I could respond to the great honour your Council has done me in asking me to give this lecture, would be to recount briefly some of the achievements of the industry during the war and to give such opinions as I have been able to form on the post-war prospects and obligations of that section of the foundry industry in which I am most intimately concerned.

Since then our armies have triumphed in the West and the prospects in the East encourage the hope of the early return of peace to the world. It is now, more than ever, our duty to get down, with the minimum of delay and with the greatest possible effort, to the vast problems which confront us in the peace.

* The Edward Williams lecture delivered to the forty-second annual meeting of the Institute of British Foundrymen.

FIG. 1.—GENERAL VIEW ALONG ONE OF THE BAYS IN THE FOUNDRY. NOTE THE LINE OF PYROMETERS MOUNTED ALONG THE FLOOR.

You will bear with me, I hope, if, for a moment, I stray from the narrow confines of my title, because the future of a section of industry cannot really be considered except against the broader background of our whole industrial future. The light alloy foundry industry has no separate future, nor has the foundry industry, nor even the metal industry. All are part of the global total of British industry, and, moreover, are strongly influenced by industry and trade throughout the world.

The demands of war have made heavy inroads into our national resources and for the first time in our history we have become a debtor nation, and that at a time when we have undertaken heavy obligations in the way of social services, of increased standards of living and full employment, social security, education reforms, and so on, and have incurred heavy debts to other countries.

Need to Increase Productivity

To meet these formidable obligations will call for a tremendous industrial effort to increase our productivity from our limited resources of man-power and capital. Increased productivity can be achieved only by increased efficiency—by an increase in the output of wealth per man-hour.

It has been shown in recent studies that the output of wealth per head of population in 1943 was from 1¾ to 2½ times as large in America as in Britain (the exact ratio depending on the figure assumed as a fair purchasing power parity between the two currencies)—and this in spite of the fact that a much higher proportion of the American labour force is in agriculture, and despite the shorter hours worked there. This means that there can be little doubt that the average American worker produces in an hour about twice as much wealth as the average British worker.

If we are to compete in international trade—and that is the only way we can obtain the essential imports of food and raw materials we need to maintain

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ourselves—we have got to achieve a comparable productivity or lower our standard of living. I do not think that anyone will welcome the latter alternative.

During the war we in the light alloy foundry industry, in common with all other industries, have seen how productivity can be increased by long-range planning and by the enthusiastic co-operation of management and labour in pursuit of a clear-cut objective.

Long-range Planning

I believe that these two factors must be continued after the war. We must somehow arouse in the people the realisation of the paramount importance of increased productivity, of the fact that on it will depend not only full employment and social security but also the maintenance of our position as a leading industrial country and even the way of life of the individual citizen. We must also see to it that production is stimulated by long-range planning—by that I do not mean the bureaucratic control of industry but the formulation of broad objectives which will spread confidence and secure continuity of production.

It must be clearly understood that the figures for productivity which I have quoted are average figures for whole national industries and, without being complacent, I can say, after studying conditions in the light alloy foundry industries both here and in America, that our principal high-production foundries are at least as efficient as their opposite numbers in the United States. I must emphasise, however, that their efficiency is proportional to the extent to which they can rely on orders for sufficient numbers of castings to enable them to construct first-class patterns, dies, and jigs and to utilise fully their machines and handling equipment.

These very efficient foundries which we have organised and equipped by our sacrifices during the war should rank as important capital assets in our national economy, and it is essential that a careful study should be made to ascertain how they will fit into our post-war industrial structure in order that the most efficient of them, if not all of them, shall remain intact, and by that I do not mean only the plant and machinery but also the fine teams of managers, technicians and craftsmen who, by their achievements, have shown their ability to organise and to improve the quantity and quality of output.

A Complex Problem

It must be conceded, of course, that the requirements of a peacetime economy will probably be far more complex than those of a war economy. There will be a far greater variety of capital and consumer goods to be made and many of these will be required in quantities which will not permit the use of mass-production methods; we must expect, therefore, a revival of the jobbing foundry to produce these goods in short runs. The actual balance between man and machine in this jobbing work will depend very largely on the numbers of young people who will enter the industry to learn its crafts and practices—I shall deal with that problem later.

FIG. 2.—VIEW OF THE TOP HALF CRANKCASE MOULDING SECTION. THE MOULDING MACHINES CAN BE SEEN IN THE BACKGROUND. IN THE FOREGROUND VARIOUS STAGES OF ASSEMBLY CAN BE SEEN.

Wartime Production

At this stage I would like to tell of a few of the achievements of the light alloy foundry industry during the war so as to provide a background for the remarks I have to make on the future prospects of this industry in the coming years of peaceful expansion.

The output of aluminium castings in the period 1924 to 1933 remained fairly steady at roughly 10,000 tons a year. In 1934-35 a 50 per cent. increase in output brought this figure up to 15,600 tons according to the fifth census of production. Output rose at an increasing rate from that time on until the outbreak of war brought about a rapid expansion of output which, it is estimated, reached about 28,000 tons in 1940, 32,000 tons in 1941, 47,000 tons in 1942, 56,000 tons in 1943, reaching a peak rate of output of about 65,000 tons early in 1944.

A very rough estimate of the structure of the industry at this peak output stage would give about 25,000 tons as the output of three firms producing over 5,000 tons a year each, about 15 or 16 thousand tons as the output of seven or eight firms producing between 1,000 and 5,000 tons a year and roughly 20,000 tons, produced mainly by about 130 light alloy foundries, with the residue made up by some 500 firms producing occasional aluminium castings.

The magnesium casting industry in this country is of more recent origin, but according to recently released figures* the output of these castings had reached a figure of 400 tons a year by 1936. The war has brought about an expansion in the production of magnesium even more spectacular in proportion than in the production of aluminium castings. The production of die-cast incendiary bombs at a peak rate of 4,327,000 castings per month accounts for a large proportion of the production of magnesium castings, representing about 700 tons a month. The rate of output of other magnesium castings was about 700 tons a month.

Equipment for Production

A significant feature of recent years has been the increasing size of castings ordered in both aluminium and magnesium base alloys, but it is not in the direction of large castings, however, that the future "bread and butter" lines of the industry lies. It must be remembered that the bulk of the equipment now available and with which we shall have to carry on during the first few years after the war is designed chiefly for the production of aircraft parts, that is mainly for small and medium sized castings. Such equipment is well suited to the quantity production of equipment, fittings and furnishings for the rehousing programme, for automobile construction, etc. The equipment capable of handling larger castings will be an asset for the shipbuilding, railway, and mechanical engineering fields.

I imagine that the light alloy foundry industry would make an interesting field for study of the industrial economists. It is a most complicated structure composed of a wide range of units from the very large firms and groups of firms down to the very smallest possible industrial unit.

Among the larger firms, *i.e.*, those with an output of 5,000 and more tons per annum, no optimum pattern can be found. One large group consists of several foundries making castings of aluminium, magnesium, iron, foundry equipment and wrought light alloy products. Another very large group of foundries is part of a much larger organisation whose principal interest lies in the manufacture of aero engines and motor-cars. Yet another organisation is devoted entirely to the manufacture of light alloy castings, while others are concerned equally with the manufacture of wrought light alloys.

If this is complicated then the structure of the smaller foundries is even more so. They range from the jobbing foundry of a large general engineering concern through a variety of foundries devoted entirely to the business of casting light alloys, to the highly specialised foundries producing nothing but die-cast aluminium pistons. With such a complex industry to deal with it is well nigh impossible to make any forecast of a general nature which could hold for anything but a particular kind of firm in the industry. With so many foundries occupying a position in some firms of relative subordinance to other manufacturing processes and dependent for their well-being upon the general success of the other activities it is difficult even to define what is and what is not to be included in the light alloy foundry industry.

Industrial Concentration

I understand that there are more than 600 foundries in the country making aluminium castings to some extent, and yet about 70 per cent. of the total output of aluminium castings comes from about a dozen firms. Owing to the much more complex processes involved in casting magnesium alloys their branch of the industry naturally tends to be more compact since the casting of magnesium necessitates far more rigid technical control and expensive and elaborate equipment.

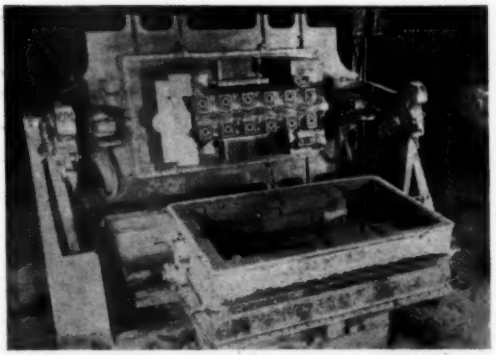

FIG. 3.—CLOSE-UP VIEW OF TOP HALF CRANKCASE MOULDING MACHINE IN THE PATTERN WITHDRAWAL POSITION.

For these and other reasons I have found it necessary to confine most of my remarks to conditions as they apply to the larger units of the industry, although, of course, much that concerns these large foundries will apply to the smaller units as well.

It would be quite impossible in the limited time available to give anything like a complete picture of the ways in which the light alloy industry has achieved its great wartime expansion. All I can do here is to show a few pictures to illustrate by way of example the way in which mechanisation has been employed to achieve very high outputs despite the severe shortage of skilled foundry workers. For this purpose I have chosen as my example the foundries of Rolls-Royce,

* THE FOUNDRY TRADE JOURNAL, April 9, 1944, p. 818.

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Limited, at Glasgow. Fig. 1 is a section of the sand foundry showing the layout of the moulding machines and conveyors, while Fig. 2 shows the moulding, core assembly and casting of the top half of the Merlin crankcase in this foundry—a fine example of the proper use of labour-saving machinery and equipment. Fig. 3 is a close-up of the moulding machine pattern and mould for this casting and clearly illustrates what can be done with first-class equipment.

Mr. Vickers has already presented at your last annual meeting a very able description of the die-casting foundry at Glasgow. Fig. 4 is a view of a production line in this foundry—the first fully mechanised gravity die-casting plant in Great Britain, while Fig. 5 shows the inspection line there and at the same time illustrates the fact that even in a foundry modern

FIG. 4.—A GENERAL VIEW OF THE GRAVITY DIE-CASTING DEPARTMENT.

Operators are shown working from the "Bale-out" type furnace to the gravity die, and a power-driven Pellet conveyor removing castings to the subsequent operations. Sawing, fettling, inspection and heat-treatment. The first fully-mechanised gravity die-casting plant in Great Britain.

conceptions of building, equipment, and layout can provide pleasant and clean working conditions.

Fig. 6 is included to illustrate what can be achieved by the use of first-class modern moulding machinery in combination with proper design and fine pattern equipment. It shows a girl making large intricate and complicated cores at the rate of 30 per shift which contrasts sharply with the six cores per shift produced by skilled coremakers by the conventional hand-making methods. Finally, Fig. 7 shows a new departure in foundry work—the jig and spot location of castings which entirely eliminates the "marking out" of castings in the machine shop and enables them to be placed directly in their machining jigs.

It would, of course, be easy to go on showing a large number of illustrations showing the many other fine foundry layouts which have been built in recent years, but I have refrained from doing so because the short time at my disposal would not permit me to do justice to their very great achievements.

Raw Material Situation

There is little need to point out that the question of price takes a paramount place in discussion of the extent and nature of future markets for light alloy castings. I have repeatedly urged the importance of positive action in this respect during the past few years. I have constantly drawn attention to the problem created by the existence of a very large light alloy fabricating industry in this country and the moderate size of our domestic resources for the production of aluminium. I have drawn attention, at every opportunity which has presented itself, to the danger of a policy of tariff barriers against overseas suppliers of cheap light metal as a threat to the existence of this large and vital industry of which the light alloy foundries are an important part.

As you know, the price of primary aluminium has now been reduced from £110 to £85 per ton, and I believe that still further reductions can be made if the import from low-cost producers is not interfered with. The time is ripe, therefore, to discuss the effects which this reduction and the improvements in production methods and equipment will produce in the price of engineering light alloy components.

In discussing this matter I immediately find myself in a somewhat difficult position. I am very strongly opposed, and I think most foundrymen will support me, to the system which has grown up in the past of quoting for castings in terms of a price per pound. This system is particularly hurtful to light alloys in comparison with the heavy metals. Few engineers would expect to buy fully machined engine parts on a weight basis nor would they expect their machines to sell by the pound.

My difficulty is to present prices in general terms without using the price per pound basis. It might be considered unethical of me to make direct comparisons between similar castings of different materials and my argument would lose weight if I were to deal with hypothetical castings. I have resolved, therefore, under the protection of the preceding remarks, to make my comparisons on the weight basis emphasising that they are so made only to facilitate generalised comparisons and that they should not be taken as signifying any concession to the system as applied to specific castings.

Competitive Position of Aluminium

In discussing this question of prices, I must first draw attention to the fact that during the past six years the normal predominance of price has had to give way to that of expediency, and it is well known that all costs have risen well above pre-war levels.

One of the best examples I know of is one of the most important light alloy castings produced by our industry during the war. It is a highly-stressed casting for an engine whose performance and reliability has been put to the very hardest test in all parts of the world. It has probably been tested more severely than any other piece of precision machinery has ever been before. The engine is the Rolls Royce Merlin engine and the casting is the crankcase.

A major proportion of these crankcases have been produced in a foundry built and equipped for full-scale mass production during the war. It is produced very largely by girls. Production has been at the rate of 500 of these complicated castings per week. When aluminium was at a controlled price of £110 per ton, or 11.8d. per lb., this casting was produced for 2s. 5d. per lb., and I would emphasise that it is a complicated casting made in a high-duty, heat-treated alloy—Hiduminium R.R.50 to be precise. With the present ruling price of £85 per ton, or 9.1d. per lb., for aluminium the casting is being made for below 2s. 3d. per lb.

Those figures refer to castings made from primary materials, but we must also take into account here another important development which has taken place during the war. I refer to the great advances made in the recovery of high quality secondary alloys from scrap. This has a very important bearing on this problem, for we are presented here with another important reduction in costs. Secondary aluminium of high quality can be made to very close composition tolerances for less than £45 per ton, or 4.8d. per lb. This means that such a casting as this could be made for less than 1s. 7d. per lb.

As I have said, this is a highly stressed and complicated sand casting. If we go a step further we come to the possibility of making a rather less complicated casting by the gravity die-casting process. I have already referred to the great achievements which have been made in the die casting of light alloys. I will take as an example one of the most important of these die castings—the bottom half crankcase of the Merlin engine—a fine die-casting job which performs a high-duty job in a high-output engine. Fig. 8 shows the die for this casting, which is shown in Fig. 9 as it comes out of the die.

I think that everyone will agree that this is a very remarkable achievement, especially so when it is borne in mind that this casting is produced to the exacting requirements of aero-engine practice with all the searching tests that implies, at a selling price of less than a shilling a lb.

Greater and More Varied Market

I think you will agree that the implications of this statement call for very deep and careful consideration. It means in effect that a similar casting of equal volume in a heavy metal, such as cast iron, would have to sell for below 4d. per lb. to equal the price of the light alloy casting, even if we omit from our considerations the further savings—and these are quite considerable—which result from the greater ease of machining the light alloy casting, its lower handling and transport costs and the premium due for its great saving in weight as a machine component. It follows that for large outputs of light alloy castings where the standards of quality are less exacting than those in force for aircraft components, still lower prices will obtain and I think that there can be very little doubt that in these circumstances we can confidently look forward to a market for light alloy castings far greater and very much more varied than anything we knew before the war.

It must, of course, be pointed out that the above remarks apply only in the case of castings made on a continuous production basis in quantities sufficient to permit the use of all the labour-saving devices which have become so highly developed during the war. The volume of orders must permit the use of the very best patterns and die equipment and the fullest utilisation of facilities for mechanised production and material handling methods.

FIG. 5.—GENERAL VIEW OF FINAL DIMENSIONAL INSPECTION. CHECKED CASTINGS ARE PLACED INTO THE PERFORATED CONTAINERS AND TRANSFERRED TO THE HEAT-TREATMENT FURNACES.

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Mechanised Production Essential

As I have said before, I do not think that this country can afford not to take the fullest possible advantage of the great asset it has created by its sacrifices during the war in the shape of these fine mechanised foundries. We must boldly undertake large-scale planning to ensure that our plans are laid sufficiently far ahead to enable us to utilise these resources and so achieve that efficiency to which we must look in the future for the maintenance of our standards of living and for our very ability to compete in the world markets for those exports with which we have to pay for our essential imports of food and raw materials.

The picture I have just drawn is that of the large mass-production foundry working at the peak of efficiency and concentrating chiefly on these applications which will allow the continuous demand for a relatively small variety of castings.

FIG. 6.—CORE-MAKING MACHINE FOR THE INTRICATE "BRICK" CORE USED IN THE CYLINDER HEAD.

A girl can turn out 30 cores in a shift, as compared with the old method of a man hand-making six in a shift. A finished core can be seen on the table at the right.

Such foundries as that I have described are an essential part of a modern industrial economy, but they are by no means the whole of the industry. There must always be the smaller jobbing and short-run production foundries to take up the thousand and one castings required in quantities insufficient to justify heavy investment in specialised equipment. Our civilisation depends on so many items, most of them of trivial importance individually, that no amount of planning can provide for all our requirements for each item to be produced to a long-term plan.

A great number of designs call for castings in which the matter of strength is of very little importance. In practically all of these the most important object is a low price for the finished goods and a pleasing appearance having sales appeal. In most cases lightness is also an advantage.

In this field I see great possibilities for large and medium scale production of pressure and gravity die casting of light alloy. Especially in this field do I visualise important applications for magnesium alloys, although I believe that the field will still be dominated by aluminium, including the secondary aluminium alloys, the production of which, to exacting standards of quality, has now become so highly developed.

Finally, I believe that there is a growing appreciation, resulting from modern developments in casting and quality control, of the economies offered by castings compared with fabricated assemblies. These will be used to an increasing extent to replace fabricated components when the particular machine or structure has been fully developed and has reached the full production stage. The engineers have already shown their confidence in castings for highly stressed components in aircraft and they are becoming increasingly appreciative of the advantages which the flexibility of the casting process offers in design and of the freedom from "stress raisers" which the jointless cast component offers.

Alloys and Alloy Development

Among the most striking features of light alloy development in this war have been the way in which alloys, well established before the war, have been able to meet the increasing demands placed upon them, the pressing into service of alloys which were in the development stage at the outbreak of war, and the upgrading of medium strength alloys, particularly those made from secondary materials to fulfil applications for which they were considered unsuitable before the war but for which they have now been proved quite inadequate.

One alloy, which was developed as long ago as 1927 to fulfil the requirements for castings for a particularly highly stressed aero-engine, has continued in service to the present day. It has been modified from time to time, of course, but it has been found capable of fulfilling the requirements of both the engineers, as regards its performance in high-output engines, and of the foundry production engineers and metallurgists, in its suitability for the production of sand, die and pressure die-cast parts in high quantity production. It is a tribute to the inventors of this alloy and to those entrusted with its subsequent development that when manufacture of the particular engine to which I refer was undertaken in America during the war attempts to replace this alloy by one of more modern development were unsuccessful and this alloy has since been used exclusively over there for this job.

The metallurgists have done a good job in developing new high-strength alloys, and very high mechanical strength and ductility have been achieved. These advances have generally, however, brought with them complications in the matter of purity, rather more

difficult foundry characteristics, or more elaborate heat-treatment processes. For these reasons the use of these materials has been limited, as it should be, of course, to those applications where their mechanical properties can be used to give a very marked advantage.

The medium strength and so called "secondary" alloys have played an important part in aircraft construction during the war. Their use was made necessary in the early days by the shortage of primary aluminium which resulted in Lord Beaverbrook's famous drive for pots and pans, but they were so well founded and the secondary aluminium industry has developed such fine methods of refining and control that these alloys have stayed on after the original reason for their use had passed away, overwhelmed by a veritable flood of primary aluminium from Canada, I have no doubt that they will continue in use for many years after the war, for in any case it has been proved beyond doubt that with modern methods of refining and analysis the secondary alloys are of very high quality and suitable for all but the most exacting requirements.

The future uses of "secondary" alloys will depend on a number of factors of which no doubt the principal one will be the difference between the prices of "primary" and "secondary" alloys and, of course, the supplies of scrap which will be available. I have already intimated that the price at which we shall be able to obtain primary aluminium will be determined in large measure by high policy and without any definite guidance from high quarters in this matter it is not possible at this time to forecast the respective roles of primary and secondary alloys in the future. I have no doubt, however, that each will have an important part to play.

Wartime Co-operation

I cannot leave this subject without paying a tribute to the fine work done in the war by the Light Metal Control, the aircraft constructors, the fabricators and the refiners in evolving and working a system of scrap segregation which has gone far to facilitate the production of secondary material to the close ranges of chemical composition which their use demanded.

It does not require much imagination to see the lines of development which lie ahead in the field of aluminium casting alloys. In the first place the greatest demand will be for alloys which will enable cheap reliable castings to be made. This will mean, no doubt, that alloys will be simple in constitution, have good casting properties, especially in respect of gravity and pressure die casting, will not require elaborate and expensive heat-treatments to develop mechanical properties adequate for the majority of purposes to which they will be applied, good resistance to corrosion and ability to take surface finishes, particularly coloured anodic coatings, which will suit them to a wide variety of surroundings.

On both sides of this core we shall develop alloys for special purposes. We shall no doubt be asked for, and shall achieve, increasingly high mechanical properties in heat-treated materials. We shall continue the work of improving the properties of alloys at elevated temperatures in order to adapt them to the increased demands of all kinds of engines including those of the internal-combustion turbine which is now developing so rapidly.

At the other end of the scale we shall see the development of low and medium strength alloys, particularly for pressure die-casting purposes, for a wide variety of applications where low cost will be the over-riding considerations and durability will be far more important than mechanical strength.

All of this adds up to the simple conclusion that so far as high-strength alloys are concerned development will continue in the pattern of the past years, while those research and development organisations which, hitherto, have devoted most of their efforts to such alloys, will pay increasing attention to the lower-strength materials.

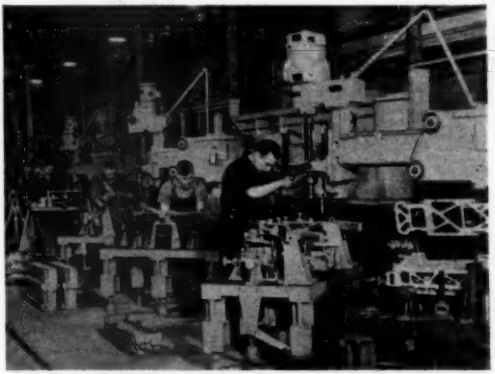

FIG. 7.—A GENERAL VIEW OF THE OPERATION OF JIG AND SPOT LOCATION OF CASTINGS.
This method eliminates the "marking out" of castings in the machine shop entirely.

Future for Magnesium Castings

It is the field of magnesium casting alloys that I anticipate the most important developments. It is only within the past two years that we have come to understand the corrosion behaviour of magnesium. It will be recalled that it is only quite recently that we were congratulating ourselves on overcoming the inclusion of electrolyte and flux which gave rise to the legend that magnesium castings were liable to disappear almost overnight.

The important work of Dr. Hanawalt on the effect of very small impurities on the corrosion resistance of magnesium has coincided with, and perhaps was partly suggested by, the new processes for producing magnesium which have come into operation since the outbreak of war. Some of these processes, in particular

the thermal reduction processes, yield a product remarkably low in those impurities which have now been found to be so severely detrimental to the corrosion resistance of magnesium and its alloys.

With this new high purity magnesium now available in commercial quantities at commercial prices, we are presented with great opportunities for the use of magnesium castings in applications where, hitherto, they would have suffered severe corrosion. At the same time we have evolved protective processes which offer greatly improved resistance to corrosion.

The present control price of magnesium ingot is 1s. 6d. per lb., yet the high purity metal from Canada could be sold in this country, at the present time, for 1s. 2d. per lb., and they have told me that it is hoped to be able soon to sell it at an even lower price.

FIG. 8.—DIE FOR CASTING THE BOTTOM HALF CRANKCASE OF THE ROLLS-ROYCE MERLIN ENGINE.

Another property of magnesium alloys which will receive attention of the research metallurgists is the relatively low yield point. Perhaps too much emphasis has been placed on the ultimate strength characteristics of magnesium alloys which, considering their low specific gravity, compare very favourably with other alloys, but the wide difference between their utimate strength and their yield point is a considerable disadvantage in practice. The properties of magnesium alloys at moderately elevated temperatures will also need to be improved if they are to be utilised for engine castings.

Research

As much as that of any other industry the future of the light alloy foundry industry is dependent on research. We require a great deal of research on new alloys and new castings processes and machines, new ways of making moulds and dies. We must enquire into the problems of resources and markets and we must study many aspects of human relations and welfare.

Confining myself to the field of scientific research and development I would stress the importance of research by individual firms as well as of co-operative research by associations. I believe that in the future no firm, least of all one in a highly technical industry like the founding of light alloys, will be able to carry on without conducting its own research into its own peculiar problems. No amount of collective research

FIG. 9.—BOTTOM HALF CRANKCASE CASTING FOR THE ROLLS-ROYCE MERLIN ENGINE AS REMOVED FROM THE DIE WITH RUNNERS AND RISERS ATTACHED.

will make up the leeway between the firm which applies research methods to its production and that which depends on information handed out to all in the industry.

I have been very impressed by the growth and the quality of work of those research foundations in the United States which provide facilities and equipment for the carrying out of research on behalf of individual companies. This sort of institution is particularly valuable to small businesses, such as those which form an important part of the light alloy foundry industry in this country, and are also very useful to the larger businesses which maintain their own research departments. I think that such institutions would be a great asset to our industrial structure in these days when to do research properly in-

volves the provision of equipment often beyond the means of the small business to maintain.

Education and Training

In 1540 Vannoccio Biringuccio wrote in his famous "Pirotechnia": ". . . the founder is always like a chimney sweep, covered with charcoal and distasteful sooty smoke, his clothing dusty and half burned by the fire, his hands and face all plastered with soft muddy earth. To this is added the fact that for this work a violent and continuous straining of all a man's strength is required, which brings great harm to his body and holds many definite dangers to his life. In addition, this art holds the mind of the artificer in suspense and fear regarding its outcome and keeps his spirit disturbed and almost continually conscious. For this reason they are called fanatics and are despised as fools. But with all this it is a profitable and skilful art and in large part delightful."

It is a far cry from Biringuccio to the modern foundries I have just illustrated, with their orderly conveyors, sand preparation plants, moulding machines and other labour-saving devices, but it is not stretching the point too far, I hope, to say that Biringuccio's remarks were almost applicable to conditions in some foundries not so very many years ago.

Because of this there has been a marked tendency for young people to think, like Biringuccio, ". . . it seems to me to be an art to be avoided as far as possible, since with so many thrusts and parryings one must fence with it in order to defend one's profit and honour," and to go in for the easier and, I regret to say, often better paid jobs as machine minders.

It is of vital interest to the industry to ensure an adequate flow of young people into the foundry to maintain that reservoir of properly trained moulders, coremakers, and patternmakers upon whose skill it is based. I am very glad to note in this connection the energetic steps which are being taken by this Institute to draw attention to the attractions of a career in the foundry.

At the same time I would like to say a word also on the position of the scientist and technician in the foundry. I think that one of the most important tasks in the future will be to keep up with scientific and technical developments as they can be applied to the foundry. A great deal of original research is being undertaken here in our universities and research institutions, and I hope that this will continue on an increasing scale as the promised additional support becomes available.

We shall lose the benefit of the great achievements of our fundamental scientists, however, unless we in industry can so organise ourselves as to apply the great advances they are making in scientific knowledge to the improvement of our materials and processes and apply them rapidly without the great time-lag between discovery and application with which we have been satisfied in the past. We must not lose the technique of the rapid exploitation of new discoveries which we have evolved under the urgency of war.

Unless we can attract a sufficient number of properly trained scientists into the foundry industry to interpret and apply the latest scientific discoveries, and unless we are prepared to give them the confidence and authority necessary to implement their projected improvements then the products of our own scientific research will go to other countries—the United States, for instance—where the scale of technological education and of the employment of scientists in industry is at present much higher than it is here.

I believe that the universities also have an obligation to condition their students for industrial life. At present the tendency is for more brilliant science graduates to stay at, or, after a brief experience of industry return to, the academic research institutions. To fulfil all our requirements for industrial research without depriving the academic laboratories we shall require larger numbers of properly trained scientists, and it is essential that the universities and the industry should co-operate to devise the means of ensuring that the young scientists destined for an industrial career shall fit easily into industry when the time comes.

Industry will then have the obligation to see that the scientists and technicians are properly rewarded for their contributions, that their work is appreciated and their achievements acknowledged. There should be no barriers to prevent them from rising, if they show the ability to the highest administrative posts. At the same time they should not be pandered to at the expense of other branches of foundrymen and on no account must we give way to the claims of the few very articulate scientists who claim that industry should be run by and for the benefit of scientists because they alone can control it in the proper way.

Conclusions

The whole of British industry has a heavy responsibility in the critical years which lie ahead of our country. Upon its ability to maintain itself at the highest pitch of efficiency will depend our place in international trade and our ability to import the food and raw materials we require, the fulfilment of our plans for a better Britain and the way of life of our people. In this tremendous task the light alloy foundry has an important part to play. In my opinion it is in fine condition to undertake its responsibilities. Great new efficient foundries are available, teams of managers, technicians and craftsmen of proven ability are eagerly awaiting the signal to start on the new tasks which lie ahead. Light alloy castings stand in high esteem among engineers, who, provided their confidence is maintained, will find increasing uses for these castings.

Research on alloys, on methods of moulding, patternmaking and die sinking; on casting methods and equipment and on the many other aspects of foundry technique must blaze the trail which must be closely followed by the application of new knowledge to production practices. We must not lose the spirit of adventure and the ability to take chances which we have learnt again during the war and in which we were sadly lacking in the years of "safety first" which preceded it.

High among our plans must rank the means of

(*Continued overleaf, column* 2.)

STEEL PRICES AND PLANTS

REPLY TO MR. BEVIN

"British steel prices are fixed by the Government and the war has delayed the modernisation of plants," says a statement issued recently by a spokesman of the British Iron and Steel Federation.

The statement is a reply to recent accusations by Mr. Ernest Bevin that enormous prices are being charged so that obsolete plants inside the "ring" can be kept in operation.

"Mr. Bevin's statement about the iron and steel industry comes strangely from a member of the late Cabinet," declared the Federation representative. "The price arrangements to which he refers were set up at the Government's request in the early stages of the war to equalise and restrict profits in the industry to ensure that steel needed for the war effort would be forthcoming. These price arrangements not only cover the problem of utilisation of the more obsolete plant to ensure greater production during the war, but also meet the position when efficient firms are called upon to use unsuitable raw materials and produce unusual products for which their plant was not intended.

"As for Mr. Bevin's contention that steel prices in the U.S. are at present less than those prevailing here, this is merely because in addition to the foregoing the steel industry, in common with the rest of British industry, has been carrying a war burden of insurance, interruption of supplies due to enemy action, and other exceptional wartime charges unknown in U.S. The greatest single factor in the price of British steel to-day is the wartime increase in the cost of coal. For example, the coke used in the blast furnaces has increased in price by 137 per cent. U.S. steel prices have risen, however, since the comparison referred to by Mr. Bevin and are likely to rise further.

"Quite apart from the Ebbw Vale scheme, other schemes of modernisation in the iron and steel industry had been completed. Others were in the process of being carried out when the war intervened and prevented further schemes of modernisation which were in contemplation being proceeded with. Mr. Bevin seems to forget that progress in the achievement of modernisation has been stopped by nearly six years of war, but blame for this cannot be laid at the door of the iron and steel industry of this country, as Mr. Bevin must be aware.

A Good Recovery

"Probably the weakest spot in British iron and steel production was iron-making. It is quite correct to say that by 1930 Britain had fallen behind in blast-furnace practice and it is equally true to say that this position has now been remedied. The majority of blast furnaces in Britain to-day are as good as any in the world. A simple illustration of the magnitude of the change which has taken place in this direction can be provided by statistics, which show that 100 blast furnaces in Britain to-day produce approximately the same tonnage as 158 in 1929.

"Critics of the industry's technical efficiency are apt to overlook the fact that the industry in Britain is designed to fulfil the requirements of our vast jobbing trade with the rest of the world. The long runs in the extensive integrated U.S. iron and steel plants are suitable for U.S. requirements, but it does not follow that the kind of production undertaken in U.S. is the right thing for Great Britain. On the contrary, our requirements are of a totally different character."

MIDLAND TECHNICIANS FOR AMERICA

Two scholarships, each value £350, for a three-month visit to America, have been awarded by the Birmingham District Production Committee Quality Control Panel, which is responsible for expanding the use in the Midland area of the new engineering inspection science of statistical quality control. The successful candidates out of 92 competitors are:—Mr. Maurice Milbourn, B.Sc. (Honours Physics), A.R.C.Sc., D.T.C., a research physicist at I.C.I. Metals, Limited; and Mr. W. A. Bennett, a member of the Institute of Engineering Inspection and an associate of the Institute of Industrial Administration. The latter was previously chief inspector and is now works manager at the English Needle & Fishing Tackle Company, Limited, Redditch.

The objects of the award are (1) to improve through personal contact British knowledge of modern developments in industrial statistics in America; (2) to add to American knowledge of similar developments in this country—a "Lease-Lend" and reverse "Lease-Lend" policy which should benefit industry in both countries; and (3) by publishing the best essays in booklet form, to add to the somewhat scanty existing bibliography on the subject.

THE FUTURE OF THE LIGHT ALLOY FOUNDRY INDUSTRY

(*Continued from previous page.*)

attracting to our industry young men and women of ability to ensure a continuous supply of new blood at all levels. Conditions of work and pay must bear comparison with those of other industries.

If we can fulfil these objectives, and I do not believe there is any doubt that we can do so by hard work, initiative, and imagination, then, provided British industry as a whole goes forward with vigour and efficiency, the light alloy foundry industry will play its part creditably and those in it will be proud to be foundrymen.

Finally, I am very pleased to acknowledge the valuable help which has been given to me in the collection of information for this Paper by Mr. John Vickers, of Rolls-Royce, Limited, and by Mr. Edward Player, of Sterling Metals, Limited.

CONSISTENCY AND THE CUPOLA

By C. A. PAYNE

Discussion on a Paper read before the East Midlands branch of the Institute of British Foundrymen, Mr. F. G. Butters presiding. Mr. Payne's Paper was printed in our issues of June 7 and 14.

MR. J. ROXBURGH said that Mr. Payne's remarks centred around the question of consistency of metal produced and he had dealt with the standardisation of the variables germane to control, but he had not given any evidence of the consistency in his analyses which he had actually obtained. Did the Author resort to some physical testing whereby he could see whether he was obtaining consistent analysis, or if his tests revealed that he was in some degree departing from the consistency desired? How then did he alter the conditions in the cupola whereby he could maintain consistency? One could, he thought, control silicon and manganese, but carbon was really a very different matter. Bamford for the purpose of his experiments had made use of a 40-in. cupola. The average foundryman would think that a 15-cwt. or 20-cwt. charge would be suitable for such a size of cupola, but the investigator found it essential in order to get consistency to reduce the charges to as low as 5 cwts. and also had made arrangements whereby his well was lined out to hold five or six charges, and it was maintained as a result of that procedure that consistency was obtained. The point was that the control of carbon in addition to the above depended on the height of the bed, the maintenance of the height of the bed, and the size and quality of the coke. He felt that Mr. Payne went to a great deal of trouble in carrying out similar investigations, because he had emphasised the importance of the coke.

Results Obtained

MR. PAYNE, in reply, said that the important point stressed by Mr. Roxburgh was the regularity of the final analyses. This was closely tied up with the size of the charge relative to the weight of the tap. Undoubtedly if three or four charges could be held in the well together, and tapped at the same time, then variations could be minimised by the mixing of high and low in the one tap. With small charges and small taps, there was a possibility that there might be an inadequate number of pieces of a given grade of pig to secure an approach to the average composition of that pig in the charge.

As regards checking the regularity of the analyses, one could take samples for chemical analysis, but the test was not of much value until the actual results were obtained. He used a quick method of testing by means of a small wedge casting made in a core, the depth of chill being taken as a guide to the uniformity of the molten metal. Variations in the chill could mean several things, the first thought usually being variations in charging practice. The man in control cannot be at the cupola spout and on the charging platform at the same time. He could see that some variation had occurred, and the first things to check were—was the material being charged correctly? was the correct material being charged? and was the correct volume of air going into the cupola?

The volume of air could vary with weather conditions and these atmospheric conditions should be checked up before the blow started so that the correct volume of air could be determined. Measurement of temperature was another important check test, because irregularity in tapping temperature definitely meant irregularity in melting conditions. Carbon control was a difficult matter, and a consistent coke supply was required, the only method of obtaining which is to find a reliable source of supply and to adhere to it.

As regards the actual range of analyses, with continuous tapping, he had obtained from a matter of 20 samples in a four hours' run, results within a range of plus or minus 0.075 per cent. silicon, the average silicon content being approximately 2 per cent. He had had also, with the same charge, but by no means with the same control, four samples from the same length of run giving a variation of 0.3 per cent. silicon. The main difference was in the quality of the charging. It was most important to achieve level charging, and to keep the charges level with the sill. What must be done, when variable results were indicated, was decided more easily with experience of the peculiarities of the cupola men, and of the results normally obtained with a particular supply of raw material.

Coke Size Variation

MR. A. E. PEACE, speaking in connection with the coke requirement, said Mr. Payne did not refer to the effect of the composition of the metal upon the eutectic carbon, and its bearing upon the reaction of the metal with the carbon of the coke. One would have to make an allowance in the coke requirement for the pick-up which would take place with some charges. Another thing that he would have liked to have seen was some more of Mr. Payne's clever way of showing things in the direction of the bulk density of coke as determined by size variation. This was one of the things foundrymen during these next few months were going to be worried about. When they were faced with variation in coke supplies, it would be helpful if there was some guide upon size variation as it affected the volume-weight conditions.

Mr. Payne had emphasised the necessity of air adjustment, and this created some difficulty, because in many cupola installations the fans were placed in various situations, depending upon local circumstances, resulting in a blast main which might have several changes of direction. Very frequently one found cupolas that had either inadequate or only just adequate air supply, so that the possibility of air adjustment was very limited. Mr. Payne had shown that if the atmospheric temperature was 55 deg. F. to-day, and to-morrow it was 35 deg. F., one needed to adjust the air volume, and similarly if the pressure changed from 30 to 28½ in. an adjustment had to be

Consistency and the Cupola

made. It would be useful if Mr. Payne would enlarge upon the actual adjustment that should be made for variations of temperature and pressure.

Air Supply

The AUTHOR, in reply, said if the carbon content in the charge be low, say, between 2 and 3 per cent., then there would be a carbon pick-up from the coke. If it be higher than, say, 3.5 per cent. then it might even lose a little carbon in melting. He had endeavoured to cover the matter of pick-up by quoting three coke ratios, 7 to 1, in which there would presumably be a large pick-up of carbon by the charge, 9 to 1, which would represent a normal pick-up, and 11 to 1, from which little pick-up would be expected. Incidentally, although ratios higher than 11 to 1 had been reported in the technical Press, he was inclined to the view that these should be considered as ideal rather than actual ratios. Dealing with the bulk density, he had tried measuring it, starting off with a 6 to 8-in. coke, from which he obtained a figure of 27 lbs. per cub. ft. By the time the size had come down to 2 in., 30½ lbs. per cub. ft. was obtained. The results over this range of sizes, obtained by another person, were almost the reverse, and obviously much depended upon the care, or otherwise, with which the measuring vessel is filled, *i.e.*, upon the packing.

When conditions or the layout resulted in having to operate below the desired air supply, the best thing would be to reduce the diameter of the cupola by increasing the thickness of the lining to bring the required air supply within the maximum obtainable. The adjustment of air volume with differing atmospheric conditions were covered in the illustration showing the combustion conditions and the amount of air per lb. of coke. The air volumes required were given as a percentage of the standard volume, and in the range that Mr. Peace mentioned these could be quite a considerable deviation from 100 per cent.

The degree of adjustment obtainable depended upon the accuracy with which one could measure the volume, and measuring with a differential manometer, results were not usually reliable to closer than plus or minus 5 per cent. Thus, air adjustments in steps of less than 5 per cent. of the standard volume were not really practicable. Another point to be considered was that the factor to convert the pressure to rate of flow was of the order of 4,000 times. Thus a slight difference in pressure meant a considerable difference in volume reading, whilst a slight adjustment on the basis of volume reading might result in no appreciable change in the flow through the blast main.

Boshed Wells

MR. W. W. BRAIDWOOD said that satisfactory cupola operation was largely a matter of good housekeeping, beginning with proper repair of the cupola followed by careful weighing and intelligent charging, and completed by clean tapping of the molten metal. His personal experience favoured finishing of the lining with a wet brush, and allowing the bed to kindle overnight, so that the lining was warm, dry and hard, and the bed thoroughly incandescent, throughout at least half of its depth, before charging was begun.

He did not agree that parallel walls were ideal in all cases, and strongly favoured a boshed contour, especially on cupolas of more than 30 in. dia. Receivers were very useful on cupolas of high melting rate and heavy output, and greatly assisted in ensuring consistency of the product, but were rarely profitable on small units. Tuyeres were best kept clean by shutting-off the blast at each individual tuyere for a few minutes at a time. Poking was a bad practice which should always be discouraged.

It had been disappointing to find no mention in the Paper of mechanical charging. The use of a suitable self-discharging skip which could deposit its contents gently and in the centre of the cupola cross-section was of the greatest help in ensuring satisfactory and economical cupola practice. Throughout the Paper one found repeated references to the "melting of a charge," as though it was considered that melting did indeed take place charge by charge. This, of course, was not the case; one had to realise the limitations of the cupola and remember constantly that at any instant the constituents of three or more separate charges might be in progress of simultaneous melting.

He had been glad to note that the lecturer had stressed the influence of blast pressure upon the height of the cupola bed. This was a point too often overlooked by people who considered that if they charged a bed to a height of, say, 36 in. above the tuyeres, it remained at that level throughout the blow. The truth was, of course, that the cupola bed adjusted itself during the melt to that height dictated by working conditions.

Starting Up Details

MR. PAYNE, in reply, said to start off with a wet brush, provided a fire was lit overnight to ensure slow and thorough drying of the lining, no harm should result. But as a more typical example of practice he was operating two cupolas, each day and every day. The patching was finished at 9 o'clock, the fire was lit at 10 o'clock, charging started at 11 o'clock, and the blower went on at 12 o'clock. Records did not show when the lining came down. Closing one tuyere at a time to clear it, was all very well if there was a large number of tuyeres, but with only three or four tuyeres all told, the unbalancing of air distribution would result in more harm than results from poking. In any case, it was judicious poking, with the emphasis on judicious, that was advocated. He agreed with the remarks on receivers.

Boshed wells on big cupolas, [illegible] big to the user of a 32-in. cupola, 60 in. i[illegible]co..pared with a 90-in. cupola, but up to 60-[illegible]ua., the range of personal experience, he did not like the system.

Regarding extra coke, use it by all means, but let it be a definite and stipulated quantity. The law of

averages would operate effectively under the conditions mentioned by Mr. Roxburgh, where 5-cwt. charges were used, and five or six charges tapped together from the well. But the charge might be a ton, and the first tap 6 cwts., and the next tap 5 cwts., and the third 7 cwts., so that the law of averages, one might say, had not time to wake up, let alone to operate.

The melting of individual charges was a convenience of presentation. He was well aware of the actual state of affairs, melting two or sometimes three mixes in the same cupola, starting with a high-phosphorus mix and ending with a high steel mix. He knew full well that when it came to the change-over, he could use the metal, say, for one particular job because he knew that job would stand it, but he could not cast any job. He had to allow a charge on either side, making at least three charges in which this dilution occurred.

Torch Lighting of Cupolas

MR. J. F. MEASURES raised two points. First, Mr. Payne condemned the use of a torch for lighting purposes. For many years he had used firewood, but due to war conditions he found it necessary to use a torch. If in the future firewood again became available, he would never dream of using it again, as a torch plus some form of blower was both more efficient and economical. Then Mr. Payne had emphasised the necessity for weighing on the charges and referred to difficulty of separating one type of metal from another when several mixtures were being melted on one furnace during one blow. He made no mention of ever attempting to weigh off the molten metal as it is tapped; this method was practised regularly in his foundry, and at the same time was such a simple matter that it would overcome all the difficulties he mentioned.

In reply, MR. PAYNE said he did not wish to condemn the torch, but the way it was usually used. He had installed a gas torch for one of his cupolas, and as a result of the experience with that, he had since converted all his cupolas to use similar equipment, but there was still that point that they could be disadvantageous when used incorrectly.

He would certainly like every batch of metal weighed out from the cupola, especially when making alloy irons by ladle additions. If the metal were weighed out as carefully as the ladle additions are, or should be, then there would be little cause for trouble with such class of material. In his case, with continuous tapping, the frequency with which ladles arrive and leave, and the considerations of space, militated against such weighing, but it was a most important factor when aiming at the maximum control of alloy irons.

MR. R. ARMITAGE said he found that it was essential that the cupola should be lit up with absolutely dry material, wood and coke, and no wet coke must be put on before any iron was charged. This part of the cupola should be as hot as possible, so that it gave life to the first metal melted, whereas with a dull bed, the molten metal would be giving heat to the coke, and it would be two or three charges before the hot metal would be obtained and there would be danger of getting iron in the tap-hole.

When the bottom plate has been placed in position it was wise to add a small layer of breeze about ¼ in. thick to remove the steam; black sand should now be rammed firmly round the outside for about 3 in. The remainder of the sand in the centre to be put on in about 1 in. thick layers and formed as for a mould, by pressing it firmly with the hands, not getting it too hard, then another inch and again pressing with the hands, continuing likewise until the bed is complete, which should then be 4 to 5 in. thick. Then, vent the sand bottom to the breeze. The sand must not be too hard, being similar to a greensand mould. When the metal commenced to melt, it would lie quietly, but if the bed was too wet or too hard it would scab continually until all the bottom was scabbed away. The reason for putting sand in 1 in. layers was to ensure even firmness throughout. The ganister should not be so wet that it would adhere to the hands, but if it was too dry it would crumble and drop off. It should be washed over with blacking and properly finished on the surface.

Bosh Profile

MR. H. L. SANDERS said that Mr. Braidwood raised a very interesting point about the bosh profile, and he agreed with him, especially as to big cupolas. One found that cupolas burnt away above the tuyeres, and this was certain to give it a boshed shape if the cupola was long in use. He knew of cupolas that had run for as long as 16 hrs. at one stretch and after the first few hours the rate of lining wear was very low. Mr. Payne inclined to the opinion that there was a critical size of charge which should not be exceeded or reduced. He knew from experience that a charge could be too large, but he had yet to come across a case of using a charge too small.

The AUTHOR, in reply, pointed out that before insistence on boshing as an advantage in big cupolas, it was necessary to define what one meant by big. No doubt there was more wear on the lining on short blows compared with the rate of wear on long runs, and he had found from personal experience that the provision of a boshed shape tended to a greater lining wear, more particularly with very high melting temperatures. The actual amount of wear would depend to a great extent upon melting conditions.

With reference to the weight of charges, a cupola would work best with a certain coke charge, upon which coke charge should be based the weight of metal charge, depending upon one's requirements. In some cases the result desired could be achieved only with small charges, but they should not be so small that one could not get a good average selection of pig with small weighings involved

After Mr. W. W. Braidwood had proposed and Mr. H. P. Radford seconded a vote of thanks to the lecturer, which was cordially received, the meeting closed.

INDUSTRIAL INJURIES BILL

HIGHER RATES OF COMPENSATION

Higher rates of compensation than some of those outlined in Part II of the White Paper on Social Insurance, published last September, are proposed in the National Insurance (Industrial Injuries) Bill, presented in the House of Commons by Mr. Hore-Belisha, Minister of National Insurance.

An explanatory memorandum, issued as a White Paper, states that, broadly speaking, the scheme will cover all persons working under a contract of service. There will be no income limit in the case of non-manual workers and no provision for contracting out. The scheme will provide benefit for persons doing rescue work in mines and elsewhere. It will also contain special provisions for certain accidents occurring while the workman is travelling to and from work.

It is now proposed that injury allowance should be 40s. a week, against the White Paper's 35s. for the first 13 weeks and 40s. thereafter, and that if the incapacity extends beyond the end of 26 weeks the allowance should be replaced by a pension. Basic rate of pension is not changed—40s. a week in the case of 100 per cent. disability, with proportionate rates for lower degrees of assessment. The White Paper proposed that, where a pensioner remained virtually unemployable, he should receive a supplementary pension of 10s. a week. It is now proposed that this supplement should be 20s. The Bill proposes that during the period of a man's injury allowance the rate for a wife or other adult dependant should be 16s. and that for a child 7s. 6d.

As to a workman in receipt of pension, under the new scheme it is proposed that, when he is earning, no dependant's allowances should be payable; when he is sick or unemployed, allowances of 16s. for an adult dependant and 7s. 6d. for a first child as part of the sickness or unemployment benefit he would get under Part I of the White Paper. These allowances of 16s. would not be payable where the wife or other adult dependant was earning more than 20s. a week.

Another new proposal is that a workman should not get sickness benefit while in receipt of an injury allowance, but if, while he is in receipt of a pension, he is or becomes incapable of work, he should be entitled, in addition to his pension, to sickness benefit, whether the incapacity is due to the injury or to some other cause.

To cover the cost of these proposals it has been decided to increase the total contribution for adults by 1d. The original proposal was that a man should pay 3d. and his employer 3d., a woman 2d. and her employer 2d. To avoid halfpennies in the deduction which the employer makes from workers' wages, it is proposed to add the extra 1d. to the employers' contribution, on the understanding that at the first suitable opportunity equality of contribution between employer and worker will be restored.

It is estimated that the annual income from the insured persons and their employers will be in the neighbourhood of £23,000,000. On this basis the annual Exchequer contribution will be about £4,500,000.

NON-FERROUS SCRAP METAL PRICES

MINISTRY OF SUPPLY SALES

The Minister of Supply has issued the following list of prices of non-ferrous scrap metals. These are prices at Ministry of Supply depots at which the Minister is prepared to effect a sale to a buyer subject to having sufficient material of that particular quality available at a convenient depot at any particular time. The list relates to the period of three months from June 11 to September 11, but is published without prejudice or commitment. Without notice the schedule of materials may be amended in the light of changing circumstances and prices may be altered in accordance with market conditions, production costs and other factors. Any inquiries should be addressed in the first instance to N.F. Metals Control (Scrap Disposals Department), Euston House, London, N.W.1. Prices are all per ton, ex works.

Copper.—Copper, clean, untinned, cut up, £56 10s.; bright untinned copper wire, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55 10s.; shell band scrap (other than turnings), £56 10s.; copper firebox plates, cut up, £57 10s.; copper turnings (including shell-band turnings), £48; braziery copper, £53 10s.; cupro-nickel scrap, 80/20, webbing, £75 10s.; cupro-nickel scrap, defective cups and envelopes before filling, £70 10s.

Lead.—Lead scrap, £25 15s.

Zinc.—Zinc scrap, £24.

Brass.—Brass ingots, £51; S.A.A. webbing, £48 10s.; defective cups and cases, £47 10s.; cut-offs and trimmings, £42 10s.; muffled cases, Grade A (electrically muffled), £47; muffled cases, Grade B (electrically muffled), £45; turnings, loose, £37; turnings, masticated, £42; fired cases, £47; fired Q.F. cases, £48 17s. 6d.; Q.F. webbing, £49; Q.F. cut-offs and trimmings, £47 10s.; Q.F. defective cups and cases, £49; Q.F. turnings, £38; other 70/30 process and manufacturing scrap, £46 10s.; 70/30 metallics, £34; 60/40 rod swarf, £30 10s.; 60/40 metallics, £27; process and manufacturing scrap containing 62 per cent. and up to 68 per cent. copper, £43 10s.; process and manufacturing scrap containing over 58 per cent. and up to 62 per cent., £38 10s.; broken-down fuse scrap, 60/40, £38; 85/15 gilding metal webbing, £52 10s.; 85/15 defective gilding metal cups and envelopes before filling, £50 10s.; 90/10 gilding metal webbing, £53 10s.; 90/10 gilding metal defective cups and envelopes before filling, £51 10s.; cap metal webbing, 95/5, £54 10s.

Gunmetal.—Scrap, Admiralty, 88/10/2, £77; scrap, Admiralty, £72 10s.

Nickel Silver.—Process and manufacturing scrap, 10 per cent., £50; 15 per cent., £56; 18 per cent., £60; 20 per cent., £63.

LEY'S MALLEABLE CASTINGS COMPANY, LIMITED, of Derby, announce that Mr. A. E. Peace and Mr. C. W. Bigg have joined the board of directors. Mr. Peace has for many years been chief metallurgist to the company, while Mr. Bigg was until recently works director of Qualcast, Limited. He is a past-president and the hon. treasurer of the Institute of British Foundrymen.

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STANTON, HOLWELL & RIXONS BRANDS

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NEWS IN BRIEF

NON-FERROUS FOUNDERS, LIMITED, is being wound up.

DURING THE WAR PERIOD, F. H. Lloyd & Company, Limited, Wednesbury, have produced 80,000 tons of finished steel castings.

ABEL, LEMON & COMPANY, PTY., LIMITED, announce that, as from July 20, their address will be 109, Fenchurch Street, London, E.C.3 (telephone: Royal 7003).

SHAREHOLDERS OF Sidney Flavel & Company, Limited, have approved a resolution increasing the capital from £82,000 to £150,000 by the creation of 340,000 4s. ordinary shares.

THE POWER GAS CORPORATION, LIMITED, of Stockton-on-Tees, an associate company of Ashmore, Benson, Pease & Company, Limited, have booked a contract of over £250,000 for the erection of a synthetic ammonia plant in the State of Travancore.

SOME RELAXATIONS in the control of factories and warehouses are being made by the Board of Trade. In future, it will no longer be necessary to have a licence for factories and warehouses which have an aggregate floor space of less than 3,000 sq. ft.

THE MINISTER OF SUPPLY has issued an Order revoking the Control of Ball and Roller Bearing (No. 2) Order, 1942, the purpose of which was to control the acquisition and stocking of ball and roller bearings by prime users. The No. 1 Order still remains in force.

THE GAUGE AND TOOL MAKERS' ASSOCIATION has established a new section for manufacturers of diamond tools and gauges. At the first meeting of the new section, held recently, Mr. Lewis E. Van Moppes, partner of L. M. Van Moppes & Sons, was elected chairman.

THE CONTRACT for rolling mills to be installed by the Darlington & Simpson Rolling Mills, Limited, for the production of special light sections has been placed with the Brightside Foundry & Engineering Company, Limited, Sheffield. The electrical equipment will be supplied by the English Electric Company, Limited, Stafford.

THE ALUMINIUM EXHIBITION which has been running at Selfridge's in Oxford Street, London, was due to be closed on Saturday, June 30. It has been so successful and well supported that it has been decided to postpone the closing date to July 14. Thereafter the exhibits will be shown in Leeds, Edinburgh, Glasgow and Birmingham.

THE CONFERENCE of the National Union of Foundry Workers at Birmingham, last week, passed a resolution demanding a substantial increase in the national minimum wage. It asked for a minimum of £4 10s. for labourers; the merging of all bonuses into the wage rate; a 40-hr. working week; 12 days' holiday with pay; and payment for Bank holidays.

DAMAGES of £1,200, with an additional agreed sum of £371 special damages, were awarded at Durham Assizes to Albert Matthew Woods (23), a fitter, of Lumley Road, Redcar, against his employers, the Cargo Fleet Iron Company, Limited. In June, 1943, Woods was working on a hydraulic press when his fingers were badly trapped, part of those on each hand having to be amputated.

GOVERNMENT SURPLUS MACHINE TOOLS

The Machine Tool Control has introduced further facilities for intending purchasers of Government surplus machine tools. For the greater convenience of intending users and merchants in all parts of the country, offers to purchase machines in the M.T.C. stock records may be lodged in person or posted to the nearest disposal centre, and the intending purchaser will be informed immediately if the machine is no longer available.

Temporary disposal centres are being established at certain large factories where a large number of surplus tools are available for sale, and the location of these will be notified from time to time. Offers for such tools will be received at the factories as well as at the permanent disposal centres. In addition, arrangements have been introduced to ensure that the latest stock changes are communicated between headquarters and the centres by telephone several times each day. These facilities will assist purchasers and merchants to ascertain promptly the prospects of obtaining the particular machines in which they are interested and also of selecting alternative machines without delay.

TRADE UNION VIEW OF STEEL INDUSTRY

The Iron and Steel Trades Confederation has issued a manifesto setting out its views on the reorganisation of the iron and steel industry.

The Confederation urges on the Government the necessity for modernisation and expansion of the industry, but states that it would involve such heavy expenditure for capital equipment that it could not be left to private enterprise. It asserts that if the number of workpeople at present dependent on the industry for their livelihood is to be assured of continuous employment and an increasing standard of life in the future, an output of 18,000,000 to 20,000,000 tons of iron and steel a year will be necessary. The Confederation recommends for plans immediately after the war the replacement of imported iron and steel products amounting to at least 2,000,000 tons a year. It is suggested that this production be carried out in one or two completely integrated plants.

CONTRACT OPEN

Any date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Birmingham, July 20—Cast-iron circulating water pipe, 34 in. and 46 in. bore, in connection with extensions to the Hams Hall "B" power station, Lea Marston, Warwickshire, for the Electricity Supply Committee. Mr. F. W. Lawton, chief engineer and manager, 14, Dale End, Birmingham, 4. (Fee £2 2s., returnable.)

COL. PENRY WILLIAMS died in a Harrogate nursing home recently, aged 78. A well-known Tees-side ironmaster, he was Liberal M.P. for Middlesbrough from 1910-18.

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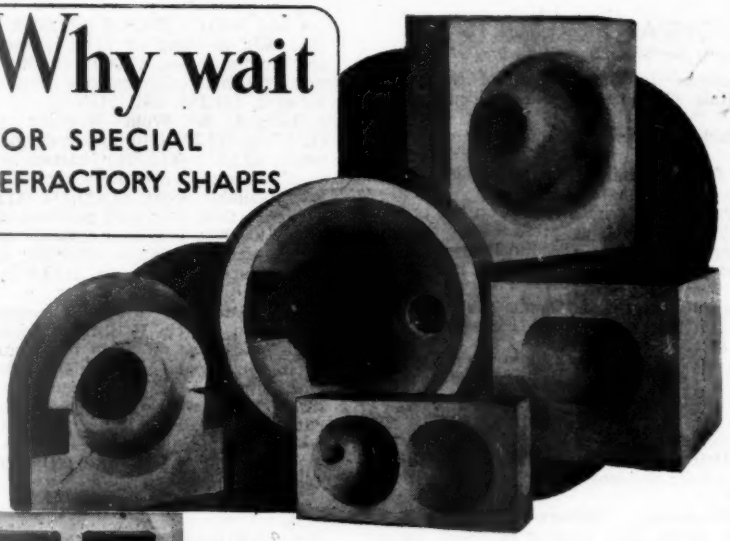

NO SHRINKAGE. Illustration (1) shows two blocks cast in moulds and dried at atmospheric temperature. One was fired to 1500° C for four hours. Specimens are the same size.

STRENGTH. Illustration (2) shows two test pieces cast in moulds, dried at atmospheric temperature and one heated to 1000° C. Tensile strength —*Unfired*, 550 lbs. per sq. in. *Fired*, 1312 lbs. per sq. in.

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COMPANY RESULTS

(Figures for previous year in brackets.)

Beans Industries—Interim dividend of 10% (same).

Hale & Hale (Tipton)—Interim dividend of 5% (same).

Modern Machine Tools—Profit, £24,531; dividend of 20% (15%).

Hammond Lane Foundry—Interim dividend of 3% (same) on the ordinary shares.

Turner & Newall—Interim dividend on the ordinary stock of 3¼% (same), less tax at 9s.

Electric Furnace Company—Second interim dividend on the ordinary shares of 4½% (same), making 8% (same).

Zinc Investments—Net profit for the year to June 30 last, £11,399 (£11,258); ordinary dividend of 5% (same); forward, £9,547 (£4,398).

W. & T. Avery—Net profit, £138,250 (£139,377); to general reserve, £20,000; contingency reserve, £45,000; final dividend of 10%, making 15%; forward, £70,477 (£68,465).

A.C.E. Machinery—Profit to September 30, after depreciation, £10,978 (£8,246); income-tax, £5,895 (£4,235); N.D.C., £636 (£410); dividend of 15% (same); forward, £6,325 (£6,750).

Textile Machinery Makers—Trading profit, £1,239,216; net profit, after making provision for depreciation, income-tax, E.P.T., etc., £107,255; ordinary dividend of 6%; forward, £68,757.

Bede Metal & Chemical—Profit for 1944, including £2,000 over-provision for taxation, no longer required, £3,560 (£3,257), after providing £4,000 (£5,000) for depreciation; dividend of 9d. per share (same); forward, £9,207 (£8,918).

Harrison (Birmingham)—Net profit for 1944, £47,917 (£54,919); adjustments relating to previous years, £3,781 (£210); surplus on sale of land, £400 (nil); dividend of 20%, tax free (same); to building reserve, £10,000 (£15,000); forward, £110,762 (£106,914).

Petrie & McNaught—Profit to April 30, including E.P.T. recoverable, and after depreciation, fees and tax, £9,119 (£10,342); preference dividend for two years to April 30, 1944, £6,856 (same); forward, £23,239 (£20,176). A further year's preference dividend now recommended will clear arrears.

Davey Paxman—Profit for the year to March 31, £59,235 (£54,114); income-tax, £36,000 (£32,500); to debenture redemption fund, £1,500 (same); to general reserve, £10,000 (same); to reserve for post-war contingencies, £5,000 (same); preference dividend, £1,000 (same); ordinary dividend of 15% (7½%); forward, £8,328 (£8,968).

Gaskell & Chambers—Trading profit for 1944, £84,532 (£84,251); depreciation, £3,094 (£3,327); war damage, £575 (£763); deferred repairs, £5,000 (nil); taxation, £31,500 (£35,000); net profit, £44,363 (£45,161); to reserve, £15,000 (nil); building fund, nil (£20,000); final dividend of 5% and a bonus of 10%, making 20% (same); forward, £33,358 (£26,074).

Gjers Mills—Trading profit for 1944, £106,747 (£59,578); bank and other interest, fees and war damage, £2,239 (£4,498); depreciation, £6,000 (same); tax and N.D.C., £54,500 (£27,000); net profit, £44,008 (£22,080); dividend of 12½% (same); deferred repairs and contingencies, £7,000 (£5,000); relining expenditure, £10,000 (nil); general reserve, £10,000 (nil); forward, £41,254 (£41,121).

Harland & Wolff—Working profit for 1944, £1,365,018 (£1,235,110); dividends and interest on investments, £15,935 (£15,706): balance of profit on settlement of contracts completed in previous years, £276,158; total available profit, £1,657,111 (£1,630,878); taxation, £715,580 (£696,715); staff pensions, £113,010; depreciation, £400,000; provision towards excess cost of wartime capital expenditure, £200,000; dividend of 7% on the ordinary stock, less tax, £153,863; forward, £135,315 (£94,157).

Park Gate Iron & Steel Company—Profit for the year ended March 31, including income from investments, and after provision for taxation, etc., £149,205 (£160,366); depreciation, £10,000 (£60,000); interest on debenture stock, £15,807; debenture stock sinking fund, £12,193; war damage insurance, £6,008 (£8,495); capital reduction expenses, £2,449 (nil); net balance, £99,868 (£60,950); dividend of 8%, less tax, £40,000 (same); to reserve, £47,500 (£20,000); forward, £36,347 (£47,958).

CORNISH TIN MINING INDUSTRY

The Minister of Fuel and Power has appointed a small technical committee to inquire into the future prospects of the Cornish tin-mining industry. Its terms of reference are:—

"To consider whether there is justification in the national interest for the granting of assistance from public funds for underground exploration at East Pool and Agar Mine for the purpose of locating additional deposits of tin ore having regard to the technical and commercial considerations involved, to the probable post-war economic position of the tin-mining industry generally in the Carn Brea area of Cornwall, and to such technical improvements in practice or changes in organisation which might be effected to ensure efficiency of operations on a normal commercial basis."

The Committee will comprise:—Mr. R. Annan, chairman of the New Consolidated Goldfields of South Africa, Limited, and ex-president of the Institution of Mining and Metallurgy; Mr. T. Pryor, technical adviser to the Ministry of Supply; Dr. W. R. Jones, Geological Department of the Royal School of Mines; and Mr. G. F. Laycock, consulting engineer of the Mining Trust, Limited.

RECENT WILLS

SHORT, T. S., chairman of Short Bros., Limited ...	£430,123
MCGLASHAN, ARCHIBALD, of West Hartlepool, director of William Gray & Company, Limited	£45,641
BINGHAM, COL. SIR ALBERT, of Retford, governing director of Walker & Hall, Limited, Sheffield, and a former Master Cutler	£981,847
TAYLOR, W. F., of Blakedown, Kidderminster, chairman and managing director of E. Baylie & Company, Limited chain manufacturers, Stourbridge	£38,670

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Raw Material Markets

IRON AND STEEL

Fuel controllers exercise unceasing vigilance to ensure the regular provision of coke for the blast furnaces, but operating, as they are, chiefly on low-grade ores, the furnaces at present in blast are barely producing sufficient iron for current needs, and it is obvious that an increased call for pig-iron—which seems likely to accrue when the housing drive gathers momentum—will not easily be satisfied. Light castings figure prominently in the list of house-builders' requirements, whether they are engaged on temporary or permanent homes, and provision of the additional labour and materials required threatens to create a serious problem. At the moment, low-phosphorus and refined irons are obtainable without much difficulty, but common foundry grades are scarce and likely so to continue.

Producers of semi-finished steel are promptly clearing the whole of their output of primes and of such defective material as accrues from their daily operations. To cope with the insistent demand for sheet bars, some of the mills have been turning out smaller tonnages of billets and, as these are also needed in fairly large quantities, the difficulties of maintaining a balanced output are apparent.

Conditions in the finished steel trade are steadily improving. Rail and sheet mills have been working to capacity for some time past, and the plate mills are the chief beneficiaries of the recent improvement. For light and medium plates, in particular, delivery dates are extending, but rollers of heavy joists, channels and sections are still able to execute orders at short notice.

NON-FERROUS METALS

Each week sees some further easing of the control over the acquisition and disposal of non-ferrous metals, and the trade is looking forward to the time when it will once more be able to conduct its own affairs in its own way. Meanwhile, a reasonable amount of metal is being released for the manufacture of civilian goods.

The Ministry of Supply has given three months' notice to Australian companies of the termination of contracts entered into at the outbreak of war for the purchase of zinc and lead supplies. The contracts will terminate on August 9 next. This is a further step in the reversion to normal buying and selling procedure. It is stated by the companies concerned that negotiations are proceeding satisfactorily for the disposal of lead and zinc in overseas markets, and it is not anticipated there will be any substantial accumulation of unsold metal during the six months following the termination of the contracts. It is expected that the British Government will continue as a purchaser of limited tonnages of lead from Australia for some months yet.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

H. & T. Mellor (Engineers), Lower Lane, Chinley, Stockport—£3,000. H. and T. Mellor.

Regent Metals, 17, Dartmouth Street, London, S.W.1—£500. R. C. Ellis and D. K. Hiscock.

Baildon Metal Products—£1,000. B. J. Williams, 66, Sidney Road, St. Margarets, Mdx, subscriber.

A.1 Die-Casting Tool Company, Arundel Road, Littlehampton. £1,000. W. E. and A. M. Aldridge.

Modern Fireplaces (Southampton), 84, Northern Road, Southampton—£2,000. J. C. and A. M. Day.

Isle of Wight Metallizing Company, 17, St. Thomas' Square, Newport, I.o.W.—£500. J. B. Stiles and H. A. Mills.

Progress Welding Company, Little Lane, Oldbury Road, West Bromwich—£1,000. J. A. Barnett and J. W. Onions.

Dowling & Fransen (Engineers), 62, South Harrow Viaduct, South Harrow, Mdx—£1,000. B. F. Fransen and J. S. H. Dowling.

Hartington Engineering Company, 117, Hartington Road, Lambeth, London, S.E.—£2,000. C. E. Moore, F. E. Groom, and J. P. Coe.

Avon Aluminium Company, Caldicot, near Chepstow, Mon—£10,000. A. A. Mansell, R. Morgan, E. R. McLaren, T. G. and D. W. Jones.

Vitreous Enamelling Industries (Bradford), Alexandra Works, Parsonage Road, Laisterdyke, Yorks—£5,000. A. Burnley, J. Edhouse, and W. Rodger.

B. & D. Products (Halifax), Fenton Road, Halifax—Brassfounders, sheet metal workers, etc. £1,000. A. and L. Crowther, J. M. and W. K. Wade.

Ronald Britton, 14, Lever Street, Piccadilly, Manchester—Merchants and manufacturers of bronze and aluminium powders, etc. £1,000. R. and B. C. Britton.

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